**Explaining Entropy change**

**1) a)** Ammonium nitrate is used in ‘cold packs’ to relieve symptoms of a sports injury. The dissolving of

the solid crystals of ammonium nitrate (shown in the equation below) is spontaneous, despite being

endothermic. Explain why this is so, in terms of the entropy change for the reaction system.

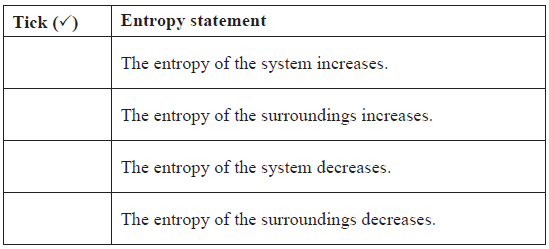
NH4NO3(*s*) → NH4+(*aq*) + NO3¯(*aq*)

**b)** Ammonium nitrate dissociates in an endothermic reaction, as shown in the equation below.

NH4NO3(*s*) → NH3(*g*) + HNO3(*g*)

Below is a table outlining four statements about changes in entropy that may occur during any reaction.

Tick to the left of any statement that is correct for the above reaction. Justify your choice.



**2)** Hydrazine is often used as a rocket fuel. When liquid hydrazine undergoes combustion, it forms nitrogen and water:

N2H4(*ℓ*) + O2(*g*) → N2(*g*) + 2H2O(*g*) Δc*H*°( N2H4 (*ℓ*)) = –624 kJ mol–1

Explain why liquid hydrazine readily burns in oxygen.

Your answer should consider both enthalpy and entropy changes.

**3)** At room temperature, 25ºC, steam condenses to water as shown in the equation below. This reaction occurs spontaneously.

H2O(*g*) 🡪 H2O(*l*)

Explain why this reaction is spontaneous by considering the entropy changes when steam condenses.

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